THE VIRGINIA TEACHER

May, 1930

OTIS W. CALDWELL

ASKS

WHAT ABOUT JUNIOR HIGH SCHOOL SCIENCE?

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SUGGESTIONS TO GENERAL SCIENCE TEACHERS IN SERVICE

HIGH SCHOOL SCIENCE SURVEY OF VIRGINIA

VIRGINIA SCIENTISTS AND INVENTORS

THE WORK OF THE WIND

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WHAT ABOUT JUNIOR HIGH SCHOOL SCIENCE?

EACH human generation seems to have its wonders, which surpass the things of common experience. We build higher buildings, deeper and longer tunnels, fly higher, farther, or for a longer time in the air. We cause chemistry, biology, or physics to do things which were recently called impossible. We see so far into space that we make our own earth almost nothing in the space it occupies, yet it is the home for the minds which learn such wonderful things. Man is a daring and adventurous animal, always wanting to try something which no one before has succeeded in doing, and always wanting to know what no one has yet learned. He is restless in the presence of things achieved, anxious always to carry his flashlight of experimentation and investigation into unexplored and dark places so that light and knowledge may dispel darkness and ignorance. He is always wanting to push back the borders of the unknown. Man's inquiring and daring mind is in itself a scientific fact of the greatest significance.

For more than a year those who can have visited the site of the New York-New Jersey-Hudson River Bridge, and such visits may be made for two years before the time of proposed completion of this spectacular structure. Foundations were laid deep below the water level in the solid, ancient rock. Cemented masonry reinforced by steel was built by men who went deep into the caissons which held the water back. Then two steel towers, one for each end of the future bridge, slowly began to rise until a height was reached 635 feet above the water of the river, a height exceeding the Washington Monument and making the height if not the behavior of Niagara Falls seem commonplace. So accurately had calculations been made and so carefully had construction work been done that the tops of the finished towers which are to support the 3500 feet of free-swinging bridge came within two-and-a-half inches of the original calculations and designs, which were made before any construction work was begun. A discrepancy of two-and-a-half inches, however, causes embarrassment to a mathematical engineer. Then the first steel cables, which had been tested in all details, were raised from the river and stretched from tower to tower. As weeks passed, these first cables were joined by others. Finally, the floor of the workers' footbridge, the so-called "cat walk," began to be appended to the temporary cables. Cages carrying workmen and materials moved slowly from the towers along the cables to a point midway between the towers and above the river, and waited in high suspension while a section of the cat walk was constructed at that dizzy height. The cages then returned for more material, repeating this journey throughout a three-week period. Men crawled along the cables, fastened sections of the temporary floor with rivets, hammered them into their proper places, then slid back to the relative security of the hanging cage or to a bit of finished floor of the cat walk. A whistling workman hanging over the edge of a moving section of the outermost part of a growing footbridge, suspended several hundred feet in the air by a few cable wires, holding to what seems from the distance to be almost nothing, reaching forward his full length to

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fasten the section on which he is riding to a part of the cable not yet reached by any foothold—he is a man of courage and self-control, engaged in one of the stupendous achievements of modern science. Each day, as the bridge grows, one's respect for modern knowledge grows, as does one's appreciation of man's intellectual and physical courage.

It takes the work of many scientists to plan and produce such a structure as the New York-New Jersey-Hudson River Bridge. Students of economic and social needs analyzed the situations, proved the need, and selected the site. Geologists studied and described the undersurface conditions to a depth of three hundred feet. Surveyors established the exact locations and relations. Engineers of many kinds planned and mathematicians calculated the materials to be used. Physicists, chemists, and biologists contributed knowledge of materials, of processes, of human relations and needs. Architects designed the structure, assembled the needed knowledge, and convinced authorities that the bridge could be built. Economists estimated the human services that would probably result and guided the financing of the giant enterprise, estimated to cost sixty million dollars. It is expected that when opened in 1932 the world's greatest bridge, in the first year of its operation, will care for the passage of not less than twenty million people.

Such achievements of modern science as that cited seem to be expected nowadays. The Zeppelin flies around the earth in a few days, making four stops en route. The inimitable Lindbergh does a new "impossible" thing every once in a while. The chemist proves that hydrogen is a compound and not the elemental substance so long regarded as one of the fundamental ideas of matter. The physicist discovers waves by means of which ideas are so readily transmitted that Byrd in the frigid antarctic talks easily with his friends and family on their hottest July day; and when we tell Byrd about our winter, he replies that the oncoming antarctic summer is his time for opening his fascinating and long-hoped-for explorations. The biologist produces foods in such abundance and of such fine quality that the food markets are overstocked, and a few of the more favored members of human society instead of being hungry are trying to keep their weight down. Our ancestors crossed the continent with great exertion, often in hunger. Today men may cross in comfortable palace cars, with food dangerously abundant, and an added danger from lack of exercise.

This wonder, after all, is not primarily in the material achievements which benefit men, great as that is. The greatest wonder is the active mind of man, always discovering and inventing new things in the fields of knowledge. Problems are solved by man's use of scientific knowledge. One great bridge when completed becomes the lesson learned, by means of which new problems are met, new lessons learned, that is, new bridges constructed. Creative achievements follow wherever science is carefully studied, and wherever scientific imagination is aroused. Communities and nations gain in material benefits, but more in growth of ideas wherever they take science study seriously. The real wonders are the increasing knowledge and daring, the knowledge-guided courage and adventure in using what is known as a means of adding new achievements.

It is knowledge of science, its ideals and its realism, not merely possession of bridges, airplanes, and huge stores of the finest foods, that is needed by the generation now rapidly becoming "the next generation." The gains by means of science are for those who learn to know science, to control scientific appliances, and to act as truth indicates that one should act. A runaway automobile is an evidence of someone's ignorance or lack of proper use of science knowledge. Do not some people possess automobiles who have little real need for going anywhere? An outbreak of typhoid, smallpox, or diphtheria is evidence of harmful ignorance. Is possession of a radio always an indication of benefits to be derived through its use? Living truly in a modern science age depends upon more than merely being alive during the period of science's greatest achievements. The general science course tries to help young people to know some of the more important aspects of modern science, and hopes to start them toward a sound belief in truth as a safe way of living.

I. *Where did the General Science Course come from?* Let us take a rather prolonged look at the educational program of introducing pupils to the study of science. There are those who think that the general science course was devised by a score, more or less, of inventive and restless science teachers who wished to change the existing order of things, and who after casting about for fertile fields of operation chose the introductory science course as the field in which to operate. Such conclusions are quite in error. Fundamental tendencies and considerations in science teaching were in operation and would have produced a changed type of introductory science course even if none of those who have written about the course had taken any hand in it. Persons do help in producing advances, but advances are so much bigger and more comprehensive than persons that they occur as movements into which individuals fit as causal incidents. A new type of introductory science course was in process of development long before anyone thought of the term "general science."

The development of new types of junior-high-school science courses was caused by several factors. The four chief factors are the movement for universal education which brought about changes in the purposes of public education; certain principles of psychology and of learning which had not previously been recognized; the widespread dissatisfaction resulting from the use of highly specialized science courses as an introduction to science study; the positive results secured from experimental work which was designed to produce a more effective foundation in science knowledge, interests, and attitudes for the uses of the average citizen. These four factors will be discussed first in the following paragraphs.

In all school systems until a few decades ago (and still in some systems) the elementary-school period, consisting usually of eight school years though sometimes of seven years, was regarded as a period of schooling designed to train in the so-called tool subjects—reading, writing, spelling, arithmetic, geography, and American history. To these subjects others were sometimes added, but little or no effort was made in the elementary schools to teach the more logical and more scholarly organized special subjects. Those pupils who went beyond the elementary schools necessarily engaged in academic study, that is, as the name implies, in the study of those subjects which had composed the program of the older academy. The academy or academic studies had been developed into a program designed to precede college studies and, to some extent, to assist in carrying on those studies in later college years. Also, as the academic, or secondary, work improved in quality, there was a tendency for certain college subjects to find their way into the upper years of the academy or high school. Then, all through the decades there have been recurring demands that there shall be introduced into the curriculum more and more material knowledge which people can use in the world of affairs. In a democracy such as ours there always has been a constant demand that education shall help people in the day's work as well as in scholarly pursuits. Education surely should help people to do better the kinds of work which their lives bring to them.

Furthermore, increasing numbers of people became ambitious and able to send their children to school beyond the elementary-school years. The commonwealth grew in its appreciation of the fact that education is essential to good citizenship. Laws for compulsory education were passed, requiring a period of schooling beyond the elementary school for all pupils who are not retarded in progress. At present every state in the Union and the District of Columbia have a law requiring school attendance. Of all the states of the Union six require school attendance until fourteen years of age, two until fifteen, thirty-one until sixteen, five until seventeen, and five until eighteen. The compulsory school-attendance laws seem to have been passed by legislatures without much consideration of whether school programs have been developed that will surely be most useful to the increased hordes of school pupils. In America we believe in education for everybody, but often we are not quite clear as to what it is that education is to do for everybody. Everyone must have it, whatever it is. Our national enthusiasm for education may be said to be universal and general, but not specific. Several movements are now in progress, looking toward better conceptions of just what this increased time expenditure in education should specifically secure. And we now soon learn that not all should remain in school so long as now required by law.

One type of consideration pertains directly to science as a factor and as an agency in universal education. In a true sense it may be said that to some extent all live in and by modern science. We cannot choose to omit it wholly, even if we would, since it has become incorporated into almost all we think and do. No recital of one's daily uses of science is necessary. Each one may produce for himself convincing proof of the inescapability of modern science. It is rather a question of whether it will be adequately understood and whether it will be controlled for worthy purposes. If science is to be understood and controlled for worthy purposes it would seem to follow that the citizens' science education should deal with those considerations and manifestations which are within his experience, not with science unrelated, abstract, and unexperienced. Thus universal education, which in period of years averages well through the junior-high-school years, would seem to demand a kind of science education in this period which shall make definite contribution to the life of the average citizen. That, therefore, is one of the major purposes of the general science course.

Certain psychological considerations helped to produce the general science course. In former times when physics, biology, or physiography was used as an introductory science course, the details, the terminology, and ever-present analysis were taught first, with the expectation that they would later fall into proper relations as the whole subject began to be appreciated. The pupil was expected to learn to measure accurately, and it was assumed that he would later have problems which would require use of his facility in accurate measurement. First he would dress himself, so to speak, with an equipment of measuring devices, then would go out to find his problem. He would learn the meaning of the terms to be applied to the divisions and processes of a science subject in order that this knowledge would be available when the logically arranged subject should later be studied. The whole theory of such teaching might be expressed as follows: first, learn details and terminology and acquire the kinds of technique and accuracy needed in the subject; then later, as the study is followed, there will come needs for these initial acquisitions. Such a theory ignored the fact that young pupils, like most older people when in a new field of study, first see and sense large units, and then later acquire details as needed, to help in the further understanding of the large unit. For example, anyone can see and appreciate the service rendered by an airplane, and most young people are interested in learning something about airplane wings and supports, driving and guiding mechanisms, and devices for maintaining balance; but only advanced study can properly deal with preferred types of ignition, with fuel tests, with qualities of steel, wood, and glass, or with detailed study of air mechanics and temperatures. Or, any young pupil may readily sense the general processes and results of the manufacture of food by green plants, and may come to think of fields of wheat and corn as man's controlled devices for causing green plants to do more food-making than they would do if growing wild. But to introduce young students to this unit of work by having them study details of leaf and stem anatomy and by explaining the intricate chemical reactions of food-making, confuses their minds with details which can take on meaning only after the larger significance of structure and functions has been acquired. Young students can see and appreciate hills, valleys, and stream flow, but to begin by exact measurement of where the hill stops and the valley begins, or by measuring the gradient of stream flow, is a "logical" and meaningless, but is not a psychological and meaningful beginning.

Therefore the introductory science course consists of large and significant units of work into which as much detail and exactness is introduced as are needed for major understandings. When the later and the more detailed studies are made, the new learning falls into its proper place in the large units with which the science study began. Thus the general science course is composed of large units of science knowledge of the kinds needed in the lives of most citizens. These units use materials from any special field of science. They build a foundation in the science that is common to life experiences. If any further courses in science are studied later, they are built where they should be, that is, upon this foundation, as the upper story of a building rests upon its foundation. Indeed, the more specialized science subjects may rise through several levels, each rising higher and becoming more specialized in its nature as the student's education continues.

In the years preceding the first efforts to teach a course in general science, various special sciences in one school or another were used as the introductory course. In none of these was there any adequate foundation of those general topics of science which would allow the student to gain an initial notion of the meaning of science. The upper stories of the house were being built without foundation, without adequate entrance ways—with windows for looking out, but with no doors for young people to enter by. General dissatisfaction resulted. The specialist authorities sometimes said the trouble was that the work was not exact enough, that not enough laboratory work was done, and that time enough was not allowed; they even said sometimes that the pupil should learn to recite principles first, and then go about to make applications of them, thus reversing the order of learning. So laboratory periods were doubled and more notebook-making was added, and more memorizing for examinations was done; but dissatisfaction increased. Then, in some of the special science courses, introductory and foundation materials were introduced. For example, physiography included topics from plant, animal, and human life, from chemistry and physics, and in some schools the first-year science time was divided between general physiography, human physiology, and hygiene. Also, the biology course when taught in the first year, instead of beginning with biological topics, began with topics in chemistry and physics which helped in understanding biology; and throughout the course in biology there now appeared abundant topics related to human physiology and hygiene. Thus general topics began to find their way into specialized subjects.

These tendencies of the special science courses to become general when they were used as the introductory science work preceded the formation of an introductory general science course. In their attempted purposes and to some extent in their efforts to include subject matter from other sciences, these courses were stages in the development of the general science course. The next step was taken when larger topics or units of science were organized with subject matter taken from any science as it was needed in the purposeful study of the topic.

Experimentation with different types of topically organized introductory science began in independent ways in a score or more of schools in various parts of the country. All had a common purpose, that is, to teach worth-while and dynamic science to young students so that they would believe in science and in its way of working, and would use science more effectively. Such a course, it was hoped, would interest pupils in further science studies either in school or out, and guide them in selecting those further studies. These experiments were surprisingly successful. No single science course has ever been adopted so widely in so short a time or studied by so many pupils. No science course has ever taken its position so definitely at a given place in the secondary-school program. It has become truly the introductory science course whether in the junior high school or in the first year of the four-year high school.

While the earlier experiments in developing the general science course did not use the same topical contents, the continuing experiments brought the different proposed courses closer and closer together. Indeed, there is some danger that too rigid standardization may result. A recent comprehensive and interesting analysis shows that the units and subtopics of the course are now definitely recognized.[1] This important study also shows that the topics of the course may readily be grouped for pupils of differing abilities, so that all may have the minimum essentials, the average student may add other valuable topics, while still other topics are available for those students who can do the largest amount of work. Such studies give a new and valid guidance to those who are interested in preparing junior-high-school science texts. The day of random guidance is passing and the day of scientific study of science teaching is arriving.

II. *How should the General Science Course be taught?* Those who teach general science should constantly keep in mind that this is general and not technical science. If what is taught is true it is science, even though its technical aspects are omitted. Therefore its topics, its experiments, and its use of environment should be determined by those aspects of science which are generally useful rather than by the needs of subsequent special studies in science. Subsequent studies, if made, will probably benefit and not suffer from the significant foundations taught in general science. It seems likely that subsequent science studies will be best served if they are wholly ignored during the study of general science. One difficulty with some general-science teaching has existed in the teacher's constant thought of one or more of the special sciences while teaching general science. His "malady of total recall" has devitalized his teaching. One must not be a teacher of any special science while he is teaching general science.

Another difficulty with teachers of introductory science is that they sometimes think that only general and indefinite results are

[1]F. D. Curtis, *A Synthesis and Evaluation of Subject-Matter Topics in General Science.* Ginn and Company, 1929.

expected. Because the topics are general it does not follow that definite results are not to be expected. This is a serious mistake, for any teaching to be worthy must produce learning that can be located. There should be quite definite objectives in mind for each unit of instruction, and careful checks should be made to be sure that these objectives have been reached. For this reason the best textbooks now include preliminary questions when beginning a topic to make sure that the pupil and teacher shall have clearly in mind with what the study deals. These questions should be read and discussed to make clear what it is all about. Then, throughout the discussion, guiding thought questions are asked, and at the close of chapters or of groups of chapters different types of specific questions are asked as to the knowledge, attitudes, and thought developed in the study. This should make sure that what was expected to be done has been done. There is a dangerous modern tendency toward the inference that a more meaningful science course suggests a less exacting course. Pupils need to accomplish more, not less, but when the topics studied are filled with meaning it should be easy to accomplish more. Definite instruction and definite check-up should help to insure better quality and quantity of accomplishment.

One major objective is to learn the scientific facts and interpretations which pertain to the use of science in modern life. Each community has weather problems, and these are good topics for study by all. They offer excellent opportunities for observation and experiment: air; air currents; air and water; air and the gases that are always found in it, the gases usually found in it, and those occasionally found in it; air condensation under natural and under mechanical pressures; the rarefaction of air and the production of a partial vacuum; use of air in caisson construction work; purifying air, and pumping air into tunnels and mines, and wherever men work in unusual situations; air in canned foods and in refrigeration; air in homes; air in action as winds—these and many other topics suggest the opportunities for demonstrations, experiments, readings, and discussions about air, which should prove useful and of interest to all citizens.

Manuals and guides for classroom use are provided in abundance for teachers and pupils. These include many specific outlines of demonstrations and experiments for school and home. They deal not only with the topic air, but with all the topics that have been shown to be the essential content of the introductory science course. Some of these guiding outlines are for all pupils in a given class, and some are organized on the plan of contracts for individuals. Most of them provide suggestions for individual-pupil initiative in discovery, or for devising inventive types of experimental work. The publisher of the textbook in use should be asked for these teachers' and pupils' guides for the work in general science. They are usually an organic part of the course.

Each classroom used for introductory science may well accumulate a store of simple illustrative materials. Pupils and teacher can make a good many pieces of simple apparatus. The simpler electrical appliances can be built by pupils with little cost. Glass and rubber tubing, plus a little ingenuity, may result in good working models of pumps, water-supply conduits, and house plumbing. An ice-cream freezer may be a better basis for learning the principles of temperature changes than the most costly apparatus. Aquariums are better apparatus for the study of plants and animals than microscopes, useful as a good microscope sometimes is. Maps, charts, and diagrams accumulated as the result of one class's work are often the beginning of the work of the next class.

There are current magazines which are of great help to the general-science teacher.

The Science News-Letter, published weekly by Science Service, Washington, D. C., is now found in the best high-school libraries, and should be in all. Many pupils, teachers, and citizens receive it regularly. It presents new things in science, things usually so new as not yet to have got into textbooks. It also tells about new books in science, and gives news as to what science men are doing. *Current Science* is a four-page paper published weekly in Columbus, Ohio. It contains many easy and interesting problems in science. *The Science Classroom,* published by the *Popular Science Monthly,* New York City, has articles in each issue by leaders in science-teaching. *The Scientific Monthly,* Lancaster, Pennsylvania, includes longer articles about new and interesting topics in science. Samples are sent of these publications on request, and teachers will find invaluable and fascinating help in one or more of them.

New and interesting books for stimulating and informing reading are constantly being made available. Selected book lists are given in the best texts on science. Long lists are not useful, since the teacher and pupil need books which have been culled from the hordes of available books. A selected list is included here. These were selected by a committee consisting of the writer of this article as chairman, with Dr. Vernon Kellogg and Dr. E. E. Slosson as committee associates. Such lists are always in need of revision, since good new books are constantly appearing. In many leading cities the newspapers now present reviews of the best of the new books on science. If encouraged by pupil and teacher inquiry it is likely that the press would increase its reviews of popular scientific books.

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Otis W. Caldwell

HIGH SCHOOL SCIENCE SURVEY OF VIRGINIA*

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*The following members of classes in the Organization of General Science and the Teaching of High School Chemistry co-operated in the preparation of this survey: M. Alma Baker, Gertrude E. Bazzle, Rebecca Beverage, Mary L. Blankenbaker, Mildred E. Blanks, Martha E. Brame, Laura Cameron, Lula Corbin, Mary T. E. Crane, Elizabeth Davis, Alice O. Elam, J. M. Garber, Virginia R. Gilliam, H. L. Jackson, Mary Ann Nichols, Pearl Noel, Clara E. Payne, Mary W. Quisenberry, Louise Renalds, Esther Smith, Frances D. Snyder, Ruby Stewart, Olivita Thomas.

1. Introduction

This survey was undertaken primarily to discover the facts regarding high school science instruction in Virginia today. It seemed to be worth while also in this paper to compare present practices in Virginia with those of other states, and to observe the results of recent researches in the teaching of science.

The data for this study were secured from the Annual Report of the Superintendent of Public Instruction of Virginia, 1928-29; from the preliminary reports of the principals of accredited high schools; from the O'Shea Survey Report,[1] and from a science survey questionnaire sent out by the High School Division of the State Board of Education.

The survey questionnaire was sent out to the principals of the 405 accredited high schools in the state, and replies were received from 226.

The data obtained in this survey should prove useful to science teacher-training classes, also to science teachers, superintendents, principals, and others interested in the application of science to various fields in the state, viz., agriculture, medicine, industry, engineering, and hygiene.

The O'Shea Survey Report[2] stated clearly that, in the commission's judgment, much more attention should be paid in the future to instruction in science. The survey staff recognized that in the past emphasis had been placed on history, languages, literature, and related subjects, but that now in a scientific age it is particularly desirable that more emphasis be placed on science courses in all grades of the elementary and high schools. The recent advent of a large number of industries in Virginia makes this all the more necessary.

Since changes in content and method of science instruction can be made wisely only

[1]Report of the Educational Commission of Virginia, by M. V. O'Shea. Richmond, Va., 1928, hereinafter called "O'Shea Survey Report."
[2]*Ibid,* p. 9 and 11.

when present practices are accurately known, and the causes therefore are clearly appreciated, it was decided to proceed with the present survey.

2. *Virginia's Predominant Type of High School*

Of the 405 high schools accredited by the State Department of Education[3] 63 have an enrollment of less than 50; 195 have an enrollment ranging from 51-100; 66 have an enrollment ranging from 101-150. The remaining 81 have an enrollment above 151. From these figures, it is evident that a large proportion of the schools (65%) have an enrollment lying between 50 and 150.

In deciding on the content of the science courses for the small town or the rural community, the predominant type will need to be kept in mind.

3. *The Typical Four Year Accredited High School*[4]

The typical county accredited four year high school in Virginia, as found in this survey, by taking averages, has an enrollment of about 80 students, and is situated in a town having a population of about 900.It has from three to four teachers, about three-quarters of whom have four years of college training.[5] The median value[6] of laboratory equipment in county high schools is $709.62, while that of city high schools is $4,100. The median number of volumes in the libraries of the counties is 595 volumes, while that for the libraries of the cities is 1.875 volumes. The median salary for the county teachers is I128.95 per month, while that for city teachers is $148.75.

It might be worth while to compare the typical high school in Virginia with that in South Dakota where the small high school also predominates. According to Jensen,[7] the typical accredited four year South Dakota high school is situated "in a town having a population of 500 and has an enrollment of about 65. This typical school has from three to four teachers, usually with from one to two years of teaching experience and 31 percent are serving as superintendents or principals, of which 20 percent have from five to six recitations per day with a three subject combination. The average value of equipment is about $275 with an average of $140 spent for new equipment each year. The least money spent for equipment purchased is $15, the most, $1200, based on 51 schools."

4. *Virginia High Schools Accredited by the Southern Association*

Of the 405 high schools in Virginia accredited by the state[8], 80 are members of the Association of Colleges and Secondary Schools of the Southern States, the leading accrediting agency of the South.[9] Each year this latter number is increasing rapidly. Of the 80 high schools 61 are public and 19 are private. The requirements for membership are: first, that 75% of teachers teaching academic subjects shall have a B. S. degree from an approved college; second, that the maximum teaching load of any teacher shall be 750 pupil-periods per week with not more than six daily recitations; third, that laboratory and library facilities shall be adequate for the needs of instruction in courses taught; fourth, that at least four teachers shall give full time to high school instruction; fifth, that the maximum number of pupils per teacher shall be 30;

[3]Annual Report of the Superintendent of Public Instruction, 1928-29. Pp. 28-45.

[4]Date secured from reports of 361 accredited high schools listed in the 1927-28 Annual Report of Public Schools, Richmond, Va.

[5]Beginning in September, 1929, graduation from a four-year coollege course is required for teaching in an accredited high school in the state.

[6]Annual Report of Public High Schools of Virginia for 1927-28, Richmond, Va., October, 1928, p. 17.

[7]High School Science Survey of South Dakota, by J. H. Jensen. *Journal of Chemical Education,* Vol. 4, No. 7, 1927, p. 897.

[8]Annual Report of the Superintendent of Public Instruction, 1928-29. Pp. 28-45.

[9]Smithey; Virginia Secondary Schools Accredited by the Association of Colleges and Secondary Schools of Southern States. *Virginia Journal of Education,* May, 1929.

sixth, that $1,000 shall be a minimum salary for teachers.

5. *Source, Preparation, Teaching Load, and Average Salary of the Teacher*

A detailed account of the source of science teachers was not available, but data for all teachers for the state as a whole may be found in the annual report.[10] The state relies chiefly on her own institutions for the training of teachers. Of the total number of teachers employed in 1928-29 67% of them were trained in state institutions; 23% in private Virginia schools; 9% in out-of-state institutions; and 1% were without any college or normal school training.

There is no reason to suppose that the source of science teachers was different from that of the teachers of the state as a whole, as shown above.

Virginia is to be commended on the improvement of the academic and professional preparation of her high school teachers.[11] The minimum qualifications for those persons beginning to teach in an accredited high school is the baccalaureate degree from a standard four-year college. "Applicants for certificates who satisfy all other requirements and present credit for 12 session hours' work (equivalent to 24 semester hours or 36 quarter hours) distributed equally among not more than three sciences may teach the sciences for which credit is presented. If, however, credit is presented for four session-hours' work each in biology, chemistry, and physics, the applicant may teach all branches of science offered in the high schools."[12] It has been recommended that no person be legally qualified to teach who has not at least a minimum professional preparation for the work he is undertaking to do. These minimum requirements as proposed consist of fifteen semester hours of professional preparation including observations and practice teaching.

The preparation of all the high school science teachers in two counties in the Shenandoah Valley was studied in detail. Of a total of 27 science teachers, 9 (33%) held an A. B. degree, 8 (about 30%) held a B. S. degree, 1 (3.7%) held both a B. S. and M. A. degree, and 9 (33%) held no degrees.

In Virginia we find the load is not excessive.[13] Few teachers teach more than 5 or 6 periods a day, or more than 150 pupils a day. This means the average size of the class is not over thirty pupils.

The average salary for the city high school teacher is $150 per month, or on a basis of a 9 month school term it is $1,350 a year. The county high school teacher's salary is $130 per month or $1,170 a year.[14]

The results of a distribution or distribution curve of equipment values is shown by the above table.[15] The average value of

6. *Value of Science Equipment, 1928-29*

TABLE I. ESTIMATED VALUE OF EQUIPMENT

Subject	Average	Median	Q_1	Q_3	Range	No. Schools Reporting
		In 31 City High Schools				
Gen. Science	$ 406	180	150	500	50-2000	20
Biology	$ 894	650	300	975	100-3547	20
Physics	$ 856	1037	700	1600	315-4120	24
Chemistry	$1759	1350	235	2000	50-9000	31
		In 374 County High Schools				
Gen. Science	$ 136	120	120	175	10- 500	320
Biology	$ 181	160	160	200	15- 900	338
Physics	$ 283	150	99	300	10-3300	71
Chemistry	$ 292	200	150	300	10-2000	284

[10]Annual Report of the Superintendent of Public Instruction. 1928-29. P. 59.

[11]*O'Shea Survey Report,* 1928, p. 186.

[12]*Regulations Governing the Certification of Teachers in Virginia.* Bulletin, State Board of Education, Richmond, Va., January, 1930, p. 6.

[13]*O'Shea Survey Report,* p. 188.

[14]*Annual Report of Superintendent of Public Instruction,* 1928-29, pp. 28-45.

[15]Data for this study were kindly furnished by Mr. Thos. D. Eason, and Mr. David Peters of the State Board of Education, Richmond, Va.

equipment for the number of schools that reported is given in the first column. Taking chemistry as an example, we see that for the 284 county high schools reporting that they teach chemistry the average value of the equipment was $292. The second column shows that the median or the measure of central tendency of the chemistry equipment for the county high school is valued at $200. This means that 50% of the schools have equipment valued above this amount and 50% are below this amount. Skipping to the fifth column, we have the range of the curve showing both the lowest and highest value of equipment. For Chemistry in the 284 county high schools reporting, the lowest value is $10 and the highest is $2,000. Column three gives Q_1, meaning the first quartile. This shows that 25% of the 284 county high schools reporting have chemistry equipment valued at less than $150. The Q_3 column shows that 25% of these schools have chemistry valued at more than $300.

(Data for this section and also for sections 8 and 9 were secured from the replies to the survey questionnaire.)

TABLE II. AMOUNT EXPENDED ANNUALLY

Subject	Average	Median	Q_1	Q_3	Range	No. Schools Reporting
		For Replacement and Breakage				
Gen. Science	$25.08	$15	$10	$30	$2-150	149
Biology	33.24	15	10	25	2-200	132
Physics	31.64	25	15	50	3-150	37
Chemistry	38.29	25	12	50	3-325	137
		For New Equipment				
Gen. Science	25.46	20	10	25	1-410	132
Biology	24.45	20	10	25	2-125	117
Physics	31.77	25	10	50	4-200	35
Chemistry	30.29	20	12	30	3-125	121

TABLE III. ESTIMATED NEED TO PROVIDE SUFFICIENT APPARATUS

Subject	Average	Median	Q_1	Q_3	Range	No. Schools Reporting
Gen. Science	$ 87.40	$ 50	$25	$100	$ 5- 750	132
Biology	126.96	50	25	150	5-1500	116
Physics	218.48	150	50	400	12-1000	33
Chemistry	137.64	50	40	150	5-1000	101

7. *Laboratory Finances*

In the 221 schools which reported, the science laboratories in 157 schools are financed by local funds (taxes) alone, 11 by laboratory fees alone, 6 by state funds, and 47 by local funds and laboratory fees.

The amount of money expended annually for replacement and breakage, and for new equipment is shown in Table II.

The number of schools reporting is small because many schools do not spend money each year for new equipment.

Table III shows the principal's estimate of the amount needed to complete the apparatus in each of the sciences in order to do efficient work. It would be well to make a study later on of the individual schools taking into account the enrollment in each science, value of apparatus on hand for each science, the values in Table III, also the state requirements as set forth in the Bulletin entitled "Laboratory Equipment for Science Instruction in High Schools of Virginia," State Board of Education, Richmond, 1924.

8. *Laboratory Work*

Data were secured on various aspects of laboratory work as shown below:

a. Size of groups

The average size of the groups working together in general science is 3 (pupils) in biology, 3; in physics, 2; and in chemistry, 3.

b. Number of experiments performed per year

The average number of experiments performed during the year in general science is 78.4; in biology, 81; in physics, 48; and in chemistry, 78.

c. Number of demonstrations performed per year
In 193 schools demonstrations performed during the year in general science range from 3 to 215; in biology from 2 to 125; in physics from 2 to 100; and in chemistry from 2 to 200.

d. Number of complete sets of apparatus
In the schools reporting, the average number of complete sets of apparatus in general science is 7, in biology 6, in physics 2, and in chemistry 7, and the range for general science is 1-85; for biology 1-50; for physics, 1-100; and for chemistry 1-50.

e. Number of rooms used for laboratory exclusively
The results indicate that in 193 schools 124 have a room used exclusively for laboratory purposes.

f. Number of rooms used for laboratory and classroom
Results indicate that in 193 schools 230 rooms are used both for laboratory and classroom purposes.

From a study of Table IV we see that of the total science enrollment in the schools reporting in the state, general science enrolls 45.2%, or almost half. Similarly, the percentages for the other three sciences are: biology, 35.7%; physics, 3.6% and chemistry, 15.4%. Why, in such a scientific age as ours, should so few take physics?

Table V shows that the average size of the sections for the whole state for the various sciences is as follows: general science, 27.6; biology, 24.8; physics, 16.9; chemistry, 17.4, the range being from 10 to 45. In a similar way the average size of sections is shown for the county and city high schools. We notice that the largest sections occur in general science in the cities. We also notice that in all the sciences the largest sections are in the cities. It should be remembered that while the city schools have larger sections, statistics show that they usually have better apparatus which offsets to some extent the disadvantage of large sections.

It is interesting to note that of 859 sections studying the sciences in the state, 380 sections have an enrollment larger than 24, which number is regarded by many teachers as the maximum for efficient work.

The average size of these sections was obtained by dividing the total number of pupils taking the science by the total number of sections.

9. Enrollment and Size of Classes

TABLE IV. ENROLLMENT IN THE SCIENCE COURSES

Location	No. Schools Reporting	General Science	Per Cent	Biol.	Per Cent	Physics	Per Cent	Chemistry	Per Cent	Total No. Pupils
State	226	9316	45.2	7346	35.7	745	3.6	3178	15.4	20,585
County	215	6138	41.9	5644	38.4	381	2.6	2499	17.1	14,662
City	11	3178	53.6	1702	28.8	364	6.7	679	11.4	5,923

TABLE V. AVERAGE SIZE OF CLASSES AND SECTIONS

Location	No. Schools Reporting	General Science	Biology	Physics	Chemistry
State	226	27.6	24.8	16.9	17.4
County	215	24.4	23.5	16.5	16.6
City	11	35.3	30.3	17.3	21.2

10. *Chemistry in the Rural High School*

While there has been great improvement in the methods of teaching and in the subject matter of chemistry during the past half century, there has been relatively little growth in its popularity as a high school subject in rural communities. This is largely due to the prevailing notion that it costs too much to install and replace material and requires a special room for the laboratory work of the course. Too, there has been an insufficiency of competent chemistry teachers available for rural schools.

The vital significance of chemistry in the lives of rural students conclusively establishes its importance in their course of study. Chemical processes are the foundation of all living, and, only as he conforms to them, can a person become a happy, healthy, efficient member of a community. The rural student's contact with the natural world necessitates an understanding of the chemistry of air, water, salts, acids, and alkalies. The predominance of his interests in food, fuel, shelter, and clothing enhances the value of a knowledge of the compounds of carbon, hydrogen, oxygen, nitrogen, etc.

The organization of a course in chemistry for rural students would probably differ from that in larger schools, for the reason that a smaller percentage of them would be specializing in the subject. Therefore, it should be an inclusive unit, developed psychologically rather than logically bearing in mind that the majority of students would not go to college. Its aims should point towards the appreciation and interpretation of the truths of chemistry and to the intelligent usage of these truths in farm life.

As for the costs of teaching chemistry in small rural schools, let us quote C. E. Osborne's paper[16] on making high school chemistry worth while: "Chemistry in the small rural and all rural high schools is of great importance. When the state supervisor of high schools asked me to tell him the minimum of equipment to teach chemistry that I considered necessary to make it worthwhile, in a small high school, I said, "a bucket of water for water supply, an empty water bucket for a waste jar, a kitchen table, a spirit lamp, and a ten dollar supply of chemicals." The only other absolute necessity, according to Mr. Osborne, is "a teacher who must know definitely what he is trying to do." The minimum requirements for high school chemical laboratory equipment in Virginia are set forth in the manual of the State Board of Education.[17]

11. *Comparison of Science Instruction in Virginia With That of Other States and With National Tendencies*

In the preceding pages several comparisons have been made already between Virginia and South Dakota. There are two reasons why South Dakota was used for comparison: first, because in both states the small type of high school predominates, and second, because data on South Dakota was available in Professor Jensen's clear, concise article.[18]

Another item may be mentioned, namely that the average value of equipment in the different sciences in these two states is nearly the same, e. g., \$136 for general science equipment in Virginia and \$134 in South Dakota. The average salary of teachers, however, in the two states is different. The salary of the rural high school teacher in Virginia was \$1,170 in 1928-29, while in South Dakota the salary in 1924-25 was \$1,425.

In a study made by George W. Hunter[19] concerning the curricular tendencies with respect to science as indicated by a study of curricular practices in 357 representative American high schools, he found that dur-

[16]*Making High School Chemistry Worth While*, C. E. Osborne, Head of Chemistry Department, Oak Park-River Forest Township High School, Oak Park, Ill. *Journal of Chemical Education*, Vol. 1, No. 5, May, 1924, p. 104.

[17]*Laboratory Equipment for Science Instruction in High Schools of Virginia*, Bulletin, State Board of Education, Richmond, Va. 1924.

[18]J. H. Jenson—High School Science Survey of South Dakota; *Journal of Chemical Education*. Vol. 4, No. 7, p. 897.

[19]George W. Hunter, *School and Society*, Dec. 13, 1924, Vol. XX, pp. 762-766.

ing fifteen years (1908-1923) the "course in general science, biology, chemistry, and physics increased in the four year secondary school; while those in physiography, botany, zoology, human physiology, and scattering courses in science have decreased." Virginia has by far a larger enrollment in general science, biology, chemistry and physics than in any of the other sciences, and thus is in line with the national tendency.

In a survey of the status of general science in California made by Will S. Kellogg[20] the statistics gathered from 337 high schools show that 92% of the high schools offer a course in general science. Virginia also has a high percent of high schools teaching general science.

Trafton[21] and others investigated the general science situation in Minnesota. Their work included a study of the changes of enrollment in the high school sciences from 1915 to 1920. The most conspicuous feature shown is the phenomenal growth of general science.

Further comparisons of science instruction in Virginia with that of other states are being worked out, and the results will be published later.

12. *Recent Researches in Science Instruction*

It is difficult to give an adequate abstract of these researches in a brief space, but, at least, the reader will be impressed with the fact that improvement investigations are being carried out in a scientific way, and that the results are of interest and value to science teachers in Virginia.

Francis D. Curtis[22] found (1) "General science on the whole is poorly taught because it is intrusted to teachers who are unprepared. (2) A general science teacher should have a knowledge of physics, chemistry, botany, zoology, astronomy and geology. (3) General science is better omitted than given as a reading course. (4) Because of lack of equipment and qualified teachers in most cases, educational agencies of every sort should discourage the tendency to introduce general science in the 8th grade of elementary schools.

The Research Bulletin[23] of the National Education Association (Sept., 1929) published a summary of Research in High School Science with references which is exceedingly valuable. Its contents are so valuable that it would be well for readers to send for it. Send twenty-five cents in stamps to the National Education Association, 1201 Sixteenth St., N. W., Washington, D. C. The article includes a modern view of the aims of science, a synopsis of various curricular studies in the field of science, and a review of recent learning studies in the field of science. Space forbids any but the briefest mention of some generalizations arrived at, which are given herewith: (1) One of the greatest needs of today is to have science instruction really prepare for rational scientific living, and thinking in our day when frauds, fads, cults and superstitions are so much in evidence. (2) The scientific attitudes should be definitely taught. (3) Studies in interest in scientific subjects on the part of adults, and girls showed that astronomy was the predominant interest. Next came the radio and various phases of electricity, followed by earthquakes, volcanoes, weather, air, airplanes, etc.

Investigations in the Teaching of Science in Secondary Schools by Francis O. Curtis (P. Blakiston's Son and Co., 1926), contains a digest of 70 different learning and curricular studies by such writers as Cunningham, Meister, Hunter, Webb, Beauchamp, Cooprider, Persing, Curtis, Finley,

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[20]W. S. Kellogg, Survey of the Status of General Science, *General Science Quarterly* VI 1921, p. 373.

[21]Trafton and Others, General Science in Minnesota. Outline of Course, *General Science Quarterly*, Vol. V. p. 207-219. November 1920.

[22]Francis D. Curtis, University of Michigan School of Education Bulletin, p. 18, November, 1929.

[23]Research Bulletin, N. E. A. September, 1929, page 218-22.

Watkins, Caldwell, and Powers. Progressive teachers would do well to secure this very worth while book.

In conclusion the writer desires to express his sincere thanks to Mr. Eason and Mr. Peters of the State Board of Education in Richmond for their hearty co-operation in this survey.

Fred C. Mabee

VIRGINIA SCIENTISTS AND INVENTORS

VIRGINIA'S roll of honor includes several scientists and inventors with whose lives and work every science teachers of our state ought to be familiar. Of these, five were selected: Maury, Mallet, McCormick, Walter Reed, and Richard Byrd. A study of the life and work of these men cannot fail to stimulate the deep interest of the teacher in the splendid work of these men, and such interest almost inevitably spreads by contagion to the pupils.

The historical background provided by these biographies, together with the recognition of the need[1] in Virginia of a *far more* intensive education on the *scientific* side, ought to produce a more stimulating type of teaching.

Dr. John C. Metcalf,[2] Dean of the Graduate School of the University of Virginia, recently called attention to the profound educational values inherent in well-written biography. He stated furthermore that in recent years biographical reading has been increasingly in vogue, and that fortunately good material has been available. It is hoped that the five brief biographies submitted herewith will serve to whet the appetite of science teachers for additional reading relating to these "science heroes"—an appetite which may be satisfied in part, at least, by the appended brief bibliographies.

[1]O'Shea Survey Report, 1928, p. 9, 11.
[2]Founder's Day address at the State Teachers College, Harrisonburg, March 24, 1930.

MATTHEW FONTAINE MAURY

Matthew Fontaine Maury was born in Spottsylvania County, Virginia, on January 14, 1806.

At the age of eighteen he joined the Navy, where he stayed until 1839, leaving because of an accident which made him a cripple for life. Soon after the accident he was put in charge of the Hydographic office in Washington. In 1861 he left this to join the Confederate Navy. Here he began the establishment of the Naval Submarine battery service at Richmond. After beginning this work Maury went to Europe, where he worked on the torpedo, trying to perfect its use. In 1868 he became professor of physics at V. M. I., Lexington, Va.; he remained there until his death in 1873. He was buried in Hollywood cementery, Richmond, Virginia.

Maury's contributions to science were concerned chiefly with the Navy, but were of far-reaching significance in several fields, *viz.*, Oceanography, Meteorology, Georgraphy. He explored the depth of the ocean and in 1855 published his *Physical Geography of the Sea and its Meteorology*. He advocated for many years the establishment of a national weather bureau especially for farmers. He conducted a systematic observation of the rise and fall of water in the Mississippi River. His life and work stand as a tremendous inspiration to any one pursuing studies in science, and should be especially stimulating to all Virginians.

Evidence that Virginians, at least, are not unmindful of his splendid service to mankind is found in buildings named in his honor, such as the High School in Norfolk, Maury-Brook Hall at V. M. I., Lexington, Va., and Maury Hall (the science building) at the Harrisonburg State Teachers College; also in a number of monuments, especially the one erected in his honor at Goshen Pass, and the one recently unveiled on Monument Avenue in Richmond.

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2. *Matthew Fontaine Maury, the Pathfinder of the Seas,* by Charles Lee Lewis, Annapolis, The U. S. Naval Institute, 1927, 264 pages, plates, portraits.
3. *Life and Letters of Maury,* by Jacqueline Ambler Caskie, Richmond Press, Inc., Richmond, Va., 1928, 191 pages.
4. *The Pathfinder of the Seas,* by John W. Wayland, Garrett and Massie, Richmond, Va., illustrated, 1930.

WALTER REED

Walter Reed was born September 13, 1851, in Gloucester County, Virginia. He was educated at the University of Virginia, Bellevue Medical School and Johns Hopkins University. In 1874 he entered the medical corps of the U. S. Army as assistant surgeon. In 1893 he was promoted to surgeon and made professor of bacteriology in the newly-organized Army Medical School. While in this position he discovered that the common house-fly is a carrier of typhoid fever. Later, in 1899, he went to Cuba with several associates to investigate the cause and method of transmission of yellow fever. He proved through a series of experiments that the yellow fever parasite was carried only by the mosquito *Aedes calopus* and that its bite caused the disease only under certain conditions. With the co-operation of the Health Department of Havana he was able to rid the city of this species of mosquito.

Reed died in Washington, D. C., November 23, 1902.

A large hospital at Washington is named after Walter Reed, as is also the physical education building at the Harrisonburg State Teachers College.

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1. *Walter Reed* (Health Heroes Series), Metropolitan Life Insurance Company, New York City.

JOHN W. MALLET

John William Mallet was born of English parents near Dublin, October 10, 1832. He was educated at the Royal College of Surgeons in Dublin and at Trinity College, University of Dublin. In 1852 he received the degree of Ph. D. at Tottingen, his thesis being a report upon the chemical examination of Celtic antiquities in the museum in Dublin. Before this time he did some work on the velocity of transmission of shocks from gunpowder explosion through loose earth.

In 1853 he came to the United States. The next year he was elected professor of Chemistry at the University of Alabama where he remained until 1861. In 1868 Dr. Mallet came to the University of Virginia to organize and build up the School of Analytical and Industrial Chemistry, conducting what is thought to be the first systematic course in industrial chemistry in the United States. Here he remained the major portion of his life.

Mallet died November 6, 1912, at the University of Virginia.

Mallet's most notable contributions to science were published in some "200 articles upon unfamiliar chemical compounds, unusual minerals, meteors, mineral waters, chemical and physical phenomena, and a number relating to the chemistry of medicine." But he also contributed very definitely to science in the training of a large number of chemists who afterwards went out into prominent positions in industry, medicine, and as teachers of chemistry.

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3. F. P. Dunnington, A Sketch of Dr. John William Mallet as a Chemist and Teacher, *Journal of Chemical Education,* Col. 5, No. 2, Feb., 1928, p. 183-188.

REAR-ADMIRAL BYRD

Richard Evelyn Byrd was born in Winchester, Va., on October 24, 1888. He was educated at Shenandoah Valley Academy, Virginia Military Institute, University of

Virginia, and U. S. Naval Academy. In 1925 he went to Greenland. In 1926, accompanied by Floyd Bennett, he flew to the North Pole and back to base at Kings Bay. This daring exploit is described in Byrd's book, *Skyward*. In 1927 he, with three companions, made a trans-Atlantic flight from New York to Paris. In both of these flights valuable scientific data was obtained. In 1929 he made a conquest of the South Pole by airplane and a geological survey of the gigantic Queen Maud Mountains (see Special Feature Section, *N. Y. Times*, February 23, 1930). Using airplane and radio this expedition has developed a new technique in the field of Antarctic exploration.

The expedition also secured valuable scientific data on the dust content of the atmosphere, snow, auroras, temperature and constitution of the Barrier, depth of the ocean at various places, and magnetic effects.

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McCORMICK

Cyrus Hall McCormick was born at Walnut Grove near Raphine, Rockbridge County, Va., in 1809. At the age of twenty-two he invented his reaper, but was unable to convince his conservative neighbors of its worth. Previous to 1845 he had sold only two of his machines, and when, in that year, he received an order for eight from Cincinnati he decided to go there to see what he might accomplish. Two years later he went to Chicago. Here he established (1847) the McCormick Harvesting Machine Co., which was the sound beginning of the present International Harvester Co.

McCormick was a liberal benefactor of worthy causes. In 1859 he contributed generously to the establishment of the Presbyterian Theological Seminary of the Northwest, later called McCormick Seminary. He also endowed a chair in Washington and Lee University.

In 1878 at the French Exposition he received for the third time the grand prize for his reaping and self-binding machine. He was also made a corresponding member of the French Academy of Sciences and an officer of the Legion of Honor.

He died in Chicago in 1884.

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4. *The New International Encyclopedia*, XII, p. 607.

Mary Anne Nichols
Clara Payne
Lena Wolfe
Gertrude Bazzle

THE WIND

A SECOND-GRADE UNIT IN NATURE STUDY

I. *Outcomes*
  A. Generalizations
    1. March is the month of winds
    2. The wind helps us in many ways
    3. Some of our loveliest poems, stories, pictures, and songs are about the wind.

II. *Experiences in School Subjects*
  A. Reading
    1. Definite use of books
      a. Using table of contents
      b. Caring for books
      c. Holding books correctly
    2. Definite reading skills
      a. Independence in word getting
      b. Reading with eyes
      c. Reading for enjoyment
      d. doing selective reading
      e. Reading to carry out directions
      f. Reading orally distinctly
  B. Art
    1. Objectives in appreciation
      a. Finding joy in beautiful color

as in wind mills, kites, weather vanes, and "March" pictures

b. Recognizing the simple evident ways wind is shown in a picture

c. Enjoyed a limited number of carefully selected pictures

(1) *The West Wind*—by Winslow Homer

(2) *The Avenue of Trees*—by Hobbema

(3) *The Harp of the Wind*—by Martin.

2. Objectives in representation

a. Selecting suitable and beautiful colors for their work

b. Knowing the correct manner to use crayons in making illustrations for their booklets

c. Representing trees, clothes, and other objects blowing in the wind

d. Some knowledge as to the relative proportions of human figures to houses, trees, and animals

3. Objectives in design

a. Ability to select suitable design for booklet

b. Knowledge of how objects may be made important by size

c. Knowlede in spacing

(1) Cover design

(2) Letters on cover

d. Knowledge in making and spacing letters on booklet

4. Objectives in construction

c. Can you hear the wind?

d. Does the noise of the wind

a. Knowledge concerning proportions

(1) How to measure a foot

(2) Difference in thick and thin materials, and knowing the most suitable place to use each

b. Ability to follow directions carefully and accurately,, as in making kites and vanes.

c. Ability to paste, cut, and tack neatly and substantially

C. Arithmetic

1. Learning to use ruler in measuring

2. Counting without using fingers

3. Learning to keep account of expenses, such as cost of kite

4. Writing numbers neatly

5. Associating numbers with things, as kites, balloons, etc.

D. Language

1. Stating title when telling story

2. Sticking to subject

3. Learning to speak clearly and with expression

4. Making topics for stories

5. Naming illustrations and pictures for booklets

6. Writing group compositions

7. Copying stories individually and illustrating

8. Acting stories or pantomimes

9. Omitting too many ands

10. Learning a few abbreviations as—

N—North

S—South

NE—Northeast

E. Music

1. Abilities in technique

a. Waiting for pitch and signal

b. Starting promptly

c. Suiting voice to size of the room

d. Suiting time to piece (as fastness and slowness).

e. Singing softly

f. Singing clearly

2. Appreciation

a. Learning to listen to music

b. Recognizing different instruments

c. Associating certain musical sounds, as a flute sounding like the wind blowing
d. A feeling for different types of rhythm

F. Physical Education
1. Enjoying racing against the wind
2. Giving pantomimes representing windmills, the wind, kites in the wind, and trees in the wind

G. Spelling
1. Learning to spell words needed in naming pictures and writing stories and poems
a. March, wind, kite, blow, vane, North, South, East, West, air, flying, moving

III. *Attitudes*
A. Appreciation for many ways the wind helps us
B. A joy in playing with the wind, as sailing a kite
C. A lack of fear of gruesome sounds wind makes
D. A love of beautiful movements wind causes in grain fields, trees, etc.
E. A spirit of co-operation in working with wind, as sailing kites, etc.
F. A keener appreciation of nature through a study of pictures, poems, songs, and stories

IV. *Jobs*
A. March is the month of winds
1. They will read poems to find out
a. What is mentioned most about the month of March
b. What sounds we hear in March
2. They will learn the following songs:
a. *March Wind* (Churchill-Grindell, Bk. VI, p. 44)
b. *The Wind and the Leaves* (Churchill-Grindell, Bk. I, p. 56)
3. They will experiment with the wind
a. Holding handkerchief to window to watch it blow (seeing what wind does)
b. Holding hand to window cracks to *feel* wind
c. Listening at different windows to *hear* sounds wind makes
d. *Watching* whirling leaves to see how wind acts
e. Flying kites to see when they are best used
4. They will discuss what causes the wind
a. They will connect little whirling wind currents with big winds
b. They will associate dense air with crowd of people
(1) Crowd of people rush to less crowded places, so does dense air
(2) Air is less dense crowded in low places
c. They will discuss the North, South, East, and West winds
(1) Telling why they are hot or cold
(2) Telling what each brings
(3) Telling how *their* weather vanes work
5. They will answer following thought questions:
a. Can you feel the wind?
b. Can you see the wind?
c. Can you hear the wind?
d. Does the noise of the wind hurt you?
e. What does a weather vane tell?
6. They will keep a record of all the windy days in March and compare number with windy days in other months

B. The wind helps us in many ways
1. They will discuss in a group how the wind helps us
a. The wind *helps us make a living* by:

(1) Turning wind mills that grind grain
(2) Drying clothes for washer women
(3) Driving fishermen's boats
(4) Helping aviators—gliders, balloons, parachutes
(5) Helping us tell weather with weather cocks

b. The wind helps nature by
(1) Scattering seeds
(2) Blowing nuts from trees
(3) Rocking birds to sleep
(4) Helping sun drive the rain clouds where they are needed
(5) Drying the earth
(6) Blowing leaves over ground to protect roots and seeds from winter cold and ice

c. The winds make us comfortable by:
(1) Blowing cool breezes from ocean to us
(2) Blowing cooling rain clouds to us
(3) Drying our clothes
(4) Blowing smoke away
(5) Clearing earth of dust and trash

d. The wind gives us pleasure by:
(1) Sailing our kites
(2) Blowing our balloons
(3) Sailing our pleasure boats

2. They will do the following things to show how the wind gives pleasure and helps us make a living:

a. They will make and fly kites
(1) They will learn how Franklin used the kite to experiment with
(2) They will learn about use of kites on Chinese and Japanese Feast Days

b. They will experiment with balloons
(1) They will fill balloons with air
(2) They will send balloons up in the air
(3) They will bring in pictures of balloons
(4) They will cut out and mount pictures

c. They will have discussion lessons on balloons
(1) They will discuss likeness of their balloons to old time balloons
(2) They will discuss difference between their balloons and balloons used today.
(3) They will compare their balloons with a dirigible
(4) They will discuss dirigibles
(a) Size
(b) Materials
(c) Name famous dirigibles
(d) Rate of travel
(e) Observation
(f) Parachutes

d. They will make paper fans and compare breeze they make with electric fan

e. They will make wind-mills, weather-vanes, whirli-gigs, and boats and experiment with them in the wind

f. They will answer the following thought questions. (Answer yes or no):
(1) A balloon is filled with air? Yes.
(2) A balloon is smaller than a dirigible? Yes.
(3) Balloons travel on the ground? No.
(4) Parachutes are like big umbrellas? Yes.

(5) Balloons and dirigibles carry people? Yes.

(6) A dirigible always goes very slowly? No.

3. They will find how the wind helps nature:
   a. By examining a milk weed pod
      (1) Looking at light weight seeds
      (2) Looking at "silky" light fibers
      (3) Blowing a few of the fibers gently
   b. By watching clouds to see how they change
   c. By pouring water on the ground and seeing how long it takes the wind to dry it up

C. Some of our loveliest poems, stories, music, and pictures are about the wind
1. They will read poems and stories listed on chart
2. They will select ten favorite poems and illustrate them. If possible, dividing them into
   a. Three that illustrate how wind helps us earn a living
   b. Three that tell how wind helps us be comfortable
   c. Three that tell how wind helps nature
   d. Three that tell how wind gives pleasure
3. They will make booklet
   a. Cover design will represent one way the wind helps us
   b. Each poem will be illustrated
   c. Each poem will be copied in booklet
   d. Original poems, stories, and cut-out pictures will be in the book
4. They will study the following pictures to show how wind gives pleasure:
   a. *The West Wind*—Winslow Homer
   b. *The Avenue of Trees*—Hobbema
   c. *The Harp of the Wind*—Martin
5. They will listen to victrola record
   a. The Wind Among the Trees—Briccialdi

BIBLIOGRAPHY FOR CHILDREN'S READING

"How Seeds Take Trips" and "Wind and Weather" in Persing and Peeples's *Elementary Science, Book II.* Appleton. (See also Books III, IV.)
"Gentle Breezes" in Christy's *Pathways in Nature.* American Book Co.
"The Wind's Work" in Lindsay's *Mother Stories.* Milton Bradley.
"The Milk Weed" in Hicks's *Nature and History Stories.* Flanagan.
"How the West Wind Saw Itself" in Meyer's *In the Green Wood.* Little, Brown.
"The Wind's Playmate" in Meyer's *The Outdoor Book.* Little, Brown.
Bailey's *For the Children's Hour.* Milton Bradley.
Smedley and Olsen's *New Second Reader.* Hall and McCreary.
"The Wind" in Simms's *Child Literature. American Book Co.*
Gardner's *Nature Stories.* Macmillan.
"The Month of March" in Withers, Browne and Tate's *The Child's World, Book, IV.* Johnson.
"The Legend of the South Wind" and "Legends of the Winds" in Pratt's *Legends of the Red Children.* American Book Co.
"The Wind" and "Flying Kites" in Lucia's *Peter and Polly in Summer.* American Book Co.
"The Wind and the Leaves" in Skinner's *Happy Tales for Story Times.* American Book Co.
Burgess's *Mother West Wind's Neighbors. Little, Brown.*
"What the Wind Did," "Flying Kites," "How Jack and Ned Made a Kite," "The Proud Weather Vane," and "Jackie Weather Vane," in Manly and Griswold's *Good Reading—First.* Scribner.
"The Wind's Work" in Smith's *The Easy Road to Reading—Second.* Lyons and Carnahan.
"The Lad Who Went to the North Wind" in Large's *Old Stories for Young Readers.* Macmillan.
"La Victoire" in Perdue's *Child Life in Other Lands.* Rand McNally.
"The North Wind" in Baker and Thorndike's *Everyday Classics, Book II.* Macmillan.
"The Wind and the Moon" by George McDonald, and "The Night Wind" by Eugene Field, in Carroll and Brooks's *Reader Book IV.*
"The Moon's the North Wind's Cooky" by Vachel Lindsay, and "Do You Fear the Wind?" by Mary Newton, in Thompson's *Silver Pennies.* Macmillan.
"Windy Nights," and "The Wind" in Stevenson's *A Child's Garden of Verses.* Scribner.
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Bessey, Bruner, Swezey—*New Elementary Agriculture.* University Publishing Co.
Poulsson—*In the Child's World.* Milton Bradley.

Persing and Wildman—*Elementary Science by Grades*. Book IV. Appleton.
Child's World Fourth Reader. Johnson.
Churchill-Grindell Song Books. Churchill-Grindell.

Bertha McCollum
Nancy Sublett
Elizabeth Russ

SUGGESTIONS TO GENERAL SCIENCE TEACHERS IN SERVICE

ESSENTIALLY the first suggestion to general science teachers in service is: Be certain of your subject matter and be acquainted with a broad field from which to gather materials as the need arises. This is possible only as a result of excellent preparation for teaching the subject and of a genuine interest in it.

In connection with the collection of materials, there are hundreds of companies, schools, and state and national departments, related to every line of interest, which are willing to send pamphlets, samples, etc., to you if you know *what and where they are.*[1]

With a subject as alive as general science should be, it is imperative that a progressive teacher not only continue enriching his background by reading new books in all fields and keeping informed as to the newest and best textbooks and manuals, but that he be a subscriber to *and reader of* the best of his field's magazines and that he also attend summer schools and extension classes to keep his "ways and means" (Sometimes called "methods") up-to-date.

After materials have been collected, it is necessary to organize them in order to get from them the maximum of aid. It is impossible to go into detail regarding methods of organization here, but any one of a number of plans on the modern "market" is usable. The main thing is to organize materials and plans around the interests of the boys and girls rather than the interests of scientists—to organize them psychologically rather than logically.

In order to teach the pupil—rather than the subject—the teacher must bring science home to him. Instead of teaching it as a body of organized knowledge, laden with words, definitions, or other abstractions, use concrete facts, experiments, demonstrations, and trips as your "Open, Sesame" to his interest. When a child can *see* a thing for himself, he can understand it. The essential technical terms should be reduced to language he can understand. The subject matter should be determined by his capacity, interests, and environment and should be arranged on a seasonal basis in order to facilitate his gathering of material. The social significance of science should be emphasized. Its importance in everyday life, the extraordinary influence it has had on recent human affairs, should be stressed as a means of making the subject live for him.

Where only the minimum of materials and equipment is available, it is well to know how to substitute and manufacture additional things from more ordinary matter. This will be a rare test of your ingenuity.

Always, a general science teacher should keep in mind, along with the scientific attitudes, an open-mindedness, and a desire for growth (since there must be either progress or deterioration in a teacher's work), the aims of general science teaching, the things a general science course should give the boys and girls: an appreciation of the value of science in modern industry and everyday life and enough knowledge of nature and the sciences to give him some control over his ordinary environment.

Mary T. E. Crane

[1]See suggested names and addresses in *How to Teach General Science*, by Frank.

PHYSICS IN THE RURAL HIGH SCHOOL

AFTER making a statistical study of science courses offered in the rural high schools of Virginia it has been found that physics is offered in fewer of the schools than any other science. This is due in part to the opinion that physics is less important than general science, biology, and chemistry, and does not warrant the expense of equipment necessary to teach it. Another influence operating in the same direction is the recommendations made a few years ago by a conference of college teachers of physics. They recommended that high school science be confined to general science, biology, and chemistry. This recommendation, if carried out, would mean that the studying of physics would be limited practically to students in college.

Rusk[1] says, "Physics stands in an unique position as the fundamental physical science." It is mainly an explanation of common things and it deals with the varied phenomena of the natural world about us, from the simplest everyday experience to those which are more remote from direct situations. In summary, physics is important because it explains the physical basis of the universe. Physics relates to the pupil's environment and to the home. In the home, the lighting and heating, farm implements, the telephone, washing and ironing, and the automobile are all evidences of the application of physics to increased comfort and increased activity.

The possibilities for correlation with home life are more evident in the rural high schools than in the city schools. In choosing the experiments and projects through which the important principles of physics are to be approached, the leading criterion for selection should be the closeness of the project to the pupil's immediate interests and environment in the home and community. For it is a fact that various physical appliances and the natural phenomena of the farm, being constantly before the eyes of the pupils, are pressing for explanations in terms of physical laws.

The expense of equipping a high school physics laboratory is a vital question and is often the rock on which the proposal to offer physics is wrecked. In this connection it is interesting to see how much money has been invested in apparatus by the 71 county schools which give a physics course in Virginia.

[1]Rusk, R. D. *How to Teach Physics*—page 5.

The cost of physics equipment in the 71 county high schools of Virginia for the session 1928-29 ranged from $10 to $3,300. The average cost of equipment in these schools which reported physics equipment was $283.42.

The cost of physics equipment in the Virginia city high schools for the session 1928-29 ranged from $600 to $4,120. The average cost of equipment in the twenty city high schools was $1521.

It is true that every school does not have sufficient equipment and funds to have a physics department, but the physics course need not be a failure on this account. Much of the equipment can be made very easily by the students at a small cost. For example, inclined planes do not have to be purchased from an instrument company, but they can be made by simply cutting three or four foot lengths from a six-inch board of pine. Many articles can be bought at the five and ten cent store: marbles (for impact), Cartesian diver, electric wire and lights, batteries, and many toys which are based on physical principles with which students and the general public are unfamiliar. A meter stick, a wooden block, a spring balance and various masses are all that is needed to do experiments on the coefficient of friction, Archimedes principle, density determinations, angle of repose, etc.

A list of equipment for a physics department with cost of each piece of apparatus for the high school may be obtained by referring to the bulletin, Laboratory Equipment for Science Instruction in the High Schools of Virginia, State Board of Education, Richmond, Va.

Science teachers intending to introduce physics into the high schools would do well to consult such modern studies as the Vestal report,[2] and an article by Herriott.[3]

Rebecca Beverage

[2]Report of the Sub-Committee of the Central Assoc. of Science and Mathematics Teachers (1920) on the content of High School Physics. C. L. Vestal, Chairman. *School Science and Mathematics*. XXI, p. 274-279 (March, 1921).

[3]M. E. Herriott, Life Activities and the Physics Curriculum. *School Science and Math.* XXIV, p. 631-4, (June, 1924).

THE VIRGINIA TEACHER

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EDUCATIONAL COMMENT

SUGGESTIONS FOR GOOD WILL PROGRAMS

The material in this bibliography is appropriate for International Good Will Day and Armistice Day. If you wish a copy of this outline, write E. Estelle Downing, State Normal College, Ypsilanti, Michigan, and enclose six cents in stamps.*

PLAYS

1. *America for Americans:* By Catherine S. Cronk. Based on the idea that both our material comforts and our luxuries are drawn in part from other lands and peoples, and that all of us in the United States except the Indians are in reality foreigners. Amusing. 12 to 18 characters. 20 minutes. Suitable for junior high school. In *Through the Gateway.* Address National Council for Prevention of War, 532 17th St., N. W., Washington, D. C. 75c
2. *They Just Won't Talk:* By Mary Katherine Reely. George comes home from the war to his family, who want to hear all about the "wonderful time" he's been having. But he refuses to satisfy their shallow curiosity and banity, and breaks into pieces the toy gun which has been given the small boy of the family in anticipation of George's home-coming. A good picture of post-war psychology. 6 characters. 20 minutes. Suitable for high school students. Printed in the VIRGINIA TEACHER (Harrisonburg) for January, 1927—Vol. 8 Single copies may be had from E. Estelle Downing, Ypsilanti, Mich. 5c.
3. *The Sword of the Samurai:* By Tracy D. Mygatt. A play in two acts, centering about the Japanese Exclusion Act of 1924, and showing the reaction of the best Japanese to that Act. Presents a vivid and intensely interesting picture of Japanese customs, culture, and ideals. 9 characters. One and one-half hours. Suitable for high school. Published by Century Co. 25c.
4. *The Enemy:* By Beulah Dix. A short and stirring little play, showing how a captured enemy officer changes a young man's views about war. 5 boys. 20 to 30 minutes. Suitable for senior high school. Address American School Citizenship League, 405 Marlborough St., Boston, Mass.
5. *Where War Comes:* By Beulah Dix. A simple play showing how one boy learned that what he had once believed about war was all wrong. 7 characters. For intermediate grades. Address same as 4.
6. *Uncle Sam's Choice:* By Anna Cope Evans. Action takes place in the office of Uncle Sam, Washington, D. C., and centers about the best way to use the national income. Children and youth plead their great need and ask for a fair share. But War demands four-fifths of the entire sum, and goes off with it. Uncle Sam, however, is greatly disturbed and declares at the end, "War shall go" 10 speaking characters and others. 30 minutes. In *Across Borderlines.* Address same as 1. 75c.
7. *A Night of the Trojan War:* By John Drinkwater. A short play of four scenes, two taking place in a Trojan tent, and two on the walls of Troy. Shows the waste and futility of war and is powerfully dramatic. 4 male characters. 30 minutes. Suitable for high schools. Printed in *Pawns.* Houghton, Mifflin. $1.50. Description of play in *Across Borderlines.* $10.00 royalty if the play is acted. Address Samuel French, 25 W. 45th St., New York City. Effective for reading with accompanying tableaux.
8. *Germany Enters the League:* By Carol Della Chiesa. A serious and dignified presentation of an historic occasion. Play includes full text of addresses by Stresemann and Briand. Male cast of 6 characters. 30 minutes. Suitable for high school. In *This Interlocking World.* Allyn and Bacon.
9. Text of several simple plays for young children can be found in the *Books of Good-Will* published by the National Council for the Prevention of war. Address same as 1.

PAGEANTS AND DRAMATIZATIONS

1. *World Unity:* By Ruth Edwards-Davis and Rachel Davis-Du Bois. An allegory tracing the story of mankind, torn through the ages by war and strife, but united at last by Education in Good Will. 28 people. 30 minutes. For high school students. In the pamphlet, "Education in Worldmindedness," for 1927-28. Address Women's International League for Peace and Freedom, 79 Halsey St., Newark, N. J. 15c.
2. *The Past of Paris:* By Grace Thomasma. A dignified representation of the signing of the Past. Entering march of the nations and their plenipotentiaries with flags and breast banners; prologue by the Spirit of Humanity; invocation by the Spirit of Peace; reading and signing of the Covenant; chorus singing; flag drill of the nations; closing march. 31 people. 35 minutes. For high school or college students. Address the author at Union High School, Grand Rapids. Mich. Postage only.

This Bibliography has been compiled by the International Relations Committee of the National Council of Teachers of English.

3. *The Loom of Friendship:* By Ruth Robinson and Donnabel Keyes. Lad and Lass wander through the world, seeking what is best in life. Find Friendship weaving on a loom colors brought from many lands. As they watch, there passes before them a pageant of many peoples, each group showing in dance and mimicry the spirit of a nation. The Lad and Lass find that Friendship is the finest thing in the world. Best for out of doors, but can be given inside. Calls for at least 100 actors. Can be given in an hour or greatly extended. Folk dancing is the outstanding feature. For high school or college students. Single copies supplied by E. Estelle Downing, Ypsilanti, Mich. Full directions with each copy. 6c.
4. *The Crowning of Science:* By Ruth Edwards-Davis and Rachel Davis-Du Bois. Allegory showing that the development of science has brought evil as well as good to the world. It will add to the health, wealth, and happiness of mankind—it will prove only a blessing, when we will have it so. 14 people. 20 minutes. For high school students. Address same as 1. 15c.
5. *The March of Peace:* By Martha Dolman Loux. Act 1 shows the early beginnings and development of trade through exchange of goods. Act 2 shows how competition in trade led to war, especially to the World War, some of the miseries of which are presented in tableaux. Act 3 gives the story of the Briand-Kellogg Peace Pact as the high- water mark of human progress. 30 to 40 people. One hour. Suitable for high school. Address Education Dept., National Council for Prevention of War, 532 17th St., N. W., Washington, D. C.
6. *International Good Will Day:* (Equally good for Armistice Day). By Estelle Downing. A general outline to be used by a single room or by an entire school. Rich in suggestions of methods and materials, and can therefore be greatly varied. Planned to tie up with the regular work in literature, history, art, music, physical training, etc. Valuable bibliography. Published in *Elementary English Review* for April, 1926—Vol. 3.
7. *Good-Will, the Magician:* By Hazel MacKaye. Brings together the children of many lands in colorful costumes, songs, and games. 100 children. 30 minutes to one hour. Suitable for upper primary grades. Address same as 5.
8. *Sons of Strangers:* By Tracy D. Mygatt. A masque showing the contributions of various nationalities to America. 40 to 60 characters. One hour and a half. Suitable for high school, with some children's parts. Address Missionary Education Movement, 150 5th Ave., N. Y. 50c.
9. *The Hope of the World:* Bradfield. Based on the achievements of the League of Nations. Dignified and informative. 25 to 50 characters. Suitable for high school. Address League of Nations Non-Partisan Association, 6 East 39th St., N. Y. Single copy free. $1.00 royalty for presentation.
10. *The Triumph of Peace:* By Anita Ferris. An allegory. War and Peace are tried by Humanity, and War is put to shame. 35 characters. One hour. Suitable for junior high school. Address same as 8. 15c.
11. *An Outline for a Model Assembly:* By Tracy D. Mygatt. Gives full directions for staging a League Assembly. 20 to 55 characters. Elastic in time limit. Suitable for high school. Address same as 9.
12. *Round the World:* The following program is suggested for a group of children representing several nationalities. Stretch a *large* outline map of the world across the front of the room, and put a large globe on the platform. Let the children in national costumes fasten to the map, one by one, colored buttons or cards to indicate their several countries. After each one has indicated his real or imagined home-land, he, alone or with others, can give a dance, a song, a game, or a talk about the country he represents. Variety in languages used will add to the interest. The exercise can be closed with a dance of the children about the globe and the singing of "America the Beautiful."

BOOKS CONTAINING PROGRAM MATERIAL

1. *Books of Good Will:* Compiled by Florence Brewer Boeckel. Two volumes. Contain stories, poems, dramas, pageants, songs, pictures, drawings, and bibliographies. Vol. I suitable for grades 1 to 6; Vol. II suitable for older boys and girls. Address National Council for the Prevention of War, 532 17th St., N. W., Washington, D. C. 75c. Two volumes in one published by Macmillan, $1.00.
2. *Cease Firing:* By Winifred Hulbert. Eight stories centering about children in foreign lands and based on actual incidents connected with the work of the League of Nations. The stories are accurate in fact basis, and are also very interestingly and sympathetically told. Excellent for retelling and dramatization. Suitable for grades and junior high School. Macmillan. $1.50.
3. *This Interlocking World:* Compiled by Mary McSkimmon and Carol-Della Chiesa. Edited by Stella S. Center. A simple anthology of prose and poetry of a distinctly international tone. Excellent material for special programs. Allyn and Bacon.
4. *Ritual and Dramatized Folkways:* By Jasspon and Becker. Dramatizations, allegories, and pantomimes based on folk legends of France, Russia, Japan, and India. Emphasize human brotherhood. Book contains music, diagrams, and costume suggestions. Century. $2.50.
5. *International Plays for Young People:* By Virginia Olcott. Includes one play each for England, Greece, Italy, France, Armenia, Germany, Japan, and Switzerland, and emphasizes what these nations have given us. All the plays short, simple, and effective. Especially suitable for junior high school. Dodd, Mead. $1.75.
6. *International Guide to Material Descriptive of Many Lands:* Excellent bibliography of children's books, plays, pageants, games, folksongs, dances, posters, pictures, maps, periodicals, and pamphlets. Full list of publishing companies and prices. Address League of Nations Non-Partisan Association, 6 East 39th St., N. Y.

7. *Between War and Peace:* By Florence Brewer Boeckel. An excellent survey of the peace movement in all its phases. Chapter XXVI, "What You Can Do for Peace," is packed full of valuable material for teachers and others. The bibliography alone is worth the price of the book. Macmillan, $2.00.
8. *Poems of the War and the Peace:* Compiled by S. A. Leonard. An admirable collection of classified poetry. Includes many poems difficult to find elsewhere. Excellent for peace programs. Suitable for high school. Harcourt, Brace. $1.35.
9. *Prince of Peace Declamation Contests:* Prose selections used in the annual declamation contests sponsored by the Ohio Council of Churches. Excellent material for school and other programs. Suitable for high school only. Address Ohio Council of Churches, Columbus, Ohio. Two volumes, 15c each.
10. *Peace Crusaders—Adventures in Good Will:* By Anna B. Griscom. A book of recitations and declarations. Address American Friends Service Committee, Philadelphia. $1.50.
11. *World Library for Children:* Edited by Helene Scheu-Riesz of Vienna. Small, paper-bound volumes of famous children's stories of all nations. 10c a volume; complete set of 34 in a case, $3.75. Address New Education Fellowship, 11 Tavistock Square, London, England.
12. *Never Again:* A group of stories reprinted from *Everyland Magazine.* Excellent for retelling and dramatization. Everyland Press, West Medford, Boston, Mass. $1.50.
13. *Folk Songs of Many Peoples:* Printed in two volumes. Vol. I, $2.75; Vol. II, $3.50. Also printed in sections at 75c each. *Words without the Music,* 15c. Address Woman's Press, 600 Lexington Ave., N. Y.
14. *Education in Worldmindedness:* By Rachel Davis Du Bois. Two valuable pamphlets presenting in detail two series of high school assembly programs. Given in Woodbury, N. J., from 1926 to 1928. The first series is based on the contributions of various racial elements to our American life; the second series, on the relation between our various school subjects and the development of worldmindedness. Both pamphlets are richly suggestive and furnish much material for school programs. Suitable for high schools. Address Women's International League for Peace and Freedom, 79 Halsey St., Newark, N. J. 15c each.
15. *Books for Children:* By Clara Whitehill Hunt. A list of 300 books for children younger and older—books of every possible kind of material about children round the world. This list has been prepared for the use of those who are sending Friendship Treasure Chests to the children of the Philippine Islands. (Project to end in 1930.) Write about the project and the book-list to the Committee on World Friendship Among Children, 289 4th Ave., New York City.

THE READING TABLE

Qualitative Analysis. By C. J. Brochman. New York: Ginn and Company, 1930. Pp. 197.

Professor Brockman's scheme of qualitative analysis offers several different and advantageous methods of separating the groups of metallic ions. It has been a general practice for many years to use hydrogen sulfide in precipitating bivalent mercury, large amounts of lead, copper, bismuth, arsenic, antimony, tin, etc. However, the resulting sulfides of these metals readily changed upon exposure to air; thus it was imperative that once the precipitation was done, the analysis of the groups contained in the precipitate should be done without delay. The method presented in this book does not use the hydrogen sulfide method.

This volume is just off the press, and its scheme of analysis makes use of some of the recently discovered reactions in the field of analytical chemistry. In many instances organic compounds are used in testing for the presence of the metallic ions. These reactions are very sensitive as well as characteristic. H. G. P.

A General Science Work Book. By Charles H. Lake, Louise E. Welton, and James C. Adell. New York: Silver, Burdett and Company. 1930. Pp. 346. $1.40.

This is primarily a book of laboratory directions for the general science student. The laboratory problems are divided into 16 units, among them water and its uses, soil, building materials, and weather.

Each unit is introduced by a series of exploratory and overview questions. This modern device should prove as stimulating and clarifying to the student in the laboratory as it has proved for textbook study in the case of several recent texts.

Other advantages are given in this quotation from the preface: "Each unit is provided with objective tests so that it is an easy matter for the teacher to check the work of each pupil. This has been found to be an excellent device for securing a maximum accomplishment by the individual pupil. In addition the workbook furnishes an abundance of material for the fastest working pupils, and also an opportunity for selection of material adapted to those who require more time to accomplish the work of any particular problem or unit. It will be found that the lessons are particularly well adapted to any plan of individual instruction in which the varying abilities of pupils is taken into account."

The book contains selected references for reading and references to the best modern general science textbooks, also a list of words, (some are technical terms) for spelling and use. Altogether this book makes a very favorable impression on the reviewer. Fred C. Mabee

How It Works. By Archibald Williams. New York: Thomas Nelson and Sons, Ltd. Thirteenth Edition—Revised. Pp. 495.

There is an increasing popular interest in the fundamental physical and chemical laws upon which our modern inventions are based. Many newspapers and periodicals are printing regularly information that is a great aid in popularizing science and that gives to the reader a deeper appreciation of the vast amount of pure scientific research behind many labor-saving devices in common use. A notable example of this is the weekly department on "How Common Things Work" in the *Literary Digest.*

How It Works gives an interesting and comprehensive explanation of the underlying principles of the mechanisms met with in everyday life. The book contains mechanical devices in the field of steam, electricity, optics, hydromechanics, heat, and combinations of these with excellent explanations.

The author makes no effort to take up the discussion of each modern invention, or variation of the same invention, but gives in terms and language easily understood by the average reader the fundamental laws governing the operation of such machines.

This book is worthy of a place in the largest and in the most meager of libraries. H. G. P.

The Radio Amateur's Handbook. By A. Frederick Collins. New York: Thomas Y. Crowell Company. Fifth Edition. Revised by George Baxter Rowe. Pp. 424.

The author of this useful and interesting book is the inventor of the wireless telephone in 1899; the revisor, Mr. Rowe, is assistant editor of the periodical, *Radio News.* Such a combination assures accurate information in the field of wireless telegraphy and wireless transmitting of sound.

This book, while written for the amateur who expects to construct wireless apparatus for sending and receiving, will interest many who own and operate the popular ready-built radio receiving sets.

A large glossary of terms peculiar to wireless is included in the book, also a summary of insurance laws and requirements. Radio Laws and Regulations of the United States are printed herein and a list of "Radio Dont's."

In concluding the volume, Mr. Rowe has written several pages concerning the more advanced improvements in the popular radio receiving sets upon the market today. H. G. P.

The Universe Around Us. By James Jean. New York: The Macmillan Co. 1929. Pp. 341. $5.00.

For several years Sir James Jean has been giving popular lectures and radio talks on methods and results of modern astronomical research. These talks are here assembled.

From the opening chapter, an introduction to astronomy, until the closing page of the final chapter, "Beginnings and Endings," the book is highly interesting. It is written in simple language; it was the author's purpose to write the entire book for readers with no special scientific knowledge.

Some of the more modern theories concerning the structure of matter, space, and time, and radio-active substances are discussed. Bohr's Atom is explained, Einstein's theory of relativity; the differences of the cosmologies of Einstein and de Sitter are also discussed.

This book is indeed a very interesting and instructive work in the field of modern science.

H. G. P.

The Extra-Curricular Library: Organization and Administration of Extra-Curricular Activities. By C. V. Millard. Home Rooms, Evan E. Evans and Malcolm S. Hallman. Student Publications By Geo. C. Wells and Wayde H. McCalister. Assembly Programs. By M. Channing Wagner. Point Systems and Awards. By Edgar C. Johnston. New York: A. S. Barnes and Co. 1930. $1.00 each.

These are volumes three to seven in the Extra Curricular Library. They are of a size that can be slipped into a coat pocket, are flexible backed, and are attractively bound. They are written for the high school principal and teachers who are interested in carrying on and directing extra curricular activities. *Organization and Administration of Extra Curricular Activities* presents a careful study of the entire field of the subject; history, growth, and present status. *Home Rooms* offers many new ideas and suggestions regarding the organization, administration, and activities of home room groups. Many home room activities, projects, and programs are suggested. *Student Publication* directs attention to methods of organization, formation of staff. and its duties, and different types of publications, such as the newspaper, the annual, the handbook, and the magazine. *Assembly Programs* abounds in practical material for the proper organization, guidance, and correlation of assembly periods, and gives many suggestive program.. *Point Systems and Awards reports* a study of schools which have some plan for guiding, stimulating, or limiting pupil participation in extra curricular activities. This little series should be of invaluable aid to the young principal and has many suggestions for the more experienced. C. P. S.

Art in Daily Activities. By James C. Boudreau and Harriett M. Cantrell. New York and Chicago: Mentzer-Bush Co. 1929. Pp. 47. 16 colored pp. Illustrated. 48 cents.

Of inestimable value to the thoughtful teacher who is endeavoring to develop real appreciation with pupils in the upper grades and the high school. The illustrations cover a wide range of daily surroundings, while the general and special activities suggested for much individual difference in pupil interests. Moreover, the book is priced within the range of grade pupils. It has received the hearty recommendation of art teachers all over this country, and of such leaders as Henry Turner Bailey and W. G. Whitford. Its use in our schools can do much to raise the level of taste, and of intelligence concerning art objects, a level which, by the way, will permit of much elevation. Grace M. Palmer

Physiographic Laboratory Sheets. By Willard B. Nelson. New York: Globe Book Company. 1930. 46 sheets. Bound, list price 80 cents, class price 60 cents; looseleaf, list price 68 cents, class price 50 cents.

Forty-six exercises for high school physiography laboratory which are unusually desirable because of the well-worded directions for work to be done and questions to be answered. The type of questions prevents any yes-or-no answers.

R. M. H.

NEWS OF THE COLLEGE

Winning every game of its season, the H. T. C. basketball team decisively defeated Slippery Rock February 21, on their home floor by a score of 21-12, each member of the local team playing a brilliant game. February 15 marked the occasion for the defeat of the Westhampton team here by the H. T. C. basketeers with a score of 27-14. The Alumnæ-Varsity game played on February 22 brought another victory for the fast-playing team with a 21-15 score. Swamping Bridgewater, H. T. C. defeated them on their home floor on February 27, by a 40-7 score. As a final victory and marking the most important matches of the season, Harrisonburg added more prestige to its wide-spread reputation by defeating New York University on its own floor with a 17-19 score, and Savage University, never before defeated on its home floor, with a score of 28-24. These games, played on Friday, March 7, and Saturday, March 8, were marked by perhaps the most brilliant playing that Harrisonburg has ever shown.

As is the quarterly custom, the local chapter of Kappa Delta Pi announced its candidates in chapel, the number of girls chosen being thirteen. Pledged on February 24, the girls are Mae Brown, Margaret Dixon, Alice Elam, Sadie Finkelstein, Catherine Firebaugh, Frances Matthews, Annie Laura Mauck, Elizabeth Oakes, Ruby Pryor, Frances Sutherland, Virginia Thomas, Lenore Thomas, and Eleanor Wrenn.

Lyceum numbers of unusual interest have been presented in the last several weeks. Dr. C. J. Chamberlain, lecturer of the University of Chicago, was heard here on February 20 in an interesting travelogue feature. March 6 marked the appearance here of John Powell, famous Virginia composer, who gave a brilliant recital.

The second class to observe its day this year, the Sophomore Class held its festivities on Friday, February 28. With green and white dotting the campus through costume and decorations, the program of the day was a decided success, carrying through the class play production held Friday night. "Two Gone," as it was named, was directed by Kitty Wherret, having in its principal rôles Henrie Steinmetz, Catherine Markham, Mary Farinholt, Isabelle DuVal, Frances Shelton, and Mary Hyde. The chorus work done by members of the class was attractively organized.

News has been received that the *Schoolma'am* of 1929, with Lucy Gilliam as editor and Catherine Guthrie as business manager, received first class honor rating in the National Scholastic Contest held yearly at the University of Minnesota, in which annuals from nearly every college in the United States are entered.

ALUMNAE NOTES

COMMENCEMENT

Mark the dates June 7-10 on your calendar and be at H. T. C. for those wonderful days. A most cordial welcome awaits you!

Registration headquarters for the alumnæ will be on the first floor of Alumnæ Hall. When you arrive on the campus, register *first* and then visit! You know how hard it is to find anyone on campus—help us all, then, by registering immediately.

Saturday, June 7, is Alumnæ Day. The meeting of the general Alumnæ Association will take place at nine-thirty and will be held in the reception room of Alumnæ Hall. All alumnæ are urged to attend this meeting.

Nobody wants to miss the alumnæ banquet on Saturday, June 7, at nine o'clock. It is one of the memoriable occasions of commencement for many reasons. The banquet is free to all those who have paid their alumnæ dues of $1.00.

Probably the one occasion the alumnæ enjoyed most last year was the Buffet Supper given for them at the Country Club on Sunday night. This affair is given by the Local Harrisonburg Alumnæ Chapter to the visiting alumnæ. If you like to have time to talk to your friends, if you like to sing, if you like fried chicken—be there!

NEWS FROM ALUMNÆ CHAPTERS

Miss Thelma Eberhart was elected president of the Norfolk Chapter of the Harrisonburg Teachers College Alumnæ Association at a reorganization meeting held in February. Miss Marjorie Ober was elected vice-president; Miss Frances Hanbury, secretary; Miss Elizabeth Mason, treasurer; Miss E. Sherwood Jones, publicity chairman. Plans were made for supporting the Johnston Memorial Fund of the college. Meetings will be held on the first Tuesday afternoon of each month.

The Alumnæ Chapter of Staunton met recently at the home of Mrs. A. A. Austin, on Frederick St. Miss Isla Eastham, the new president of the chapter, presided at the meeting. Mrs. Harry Garber and Miss Sarah Elizabeth Thompson, of Harrisonburg, were the visiting alumnæ present. After the business meeting, delicious refreshments were served by Mrs. Austin, the vice-president of the chapter, assisted by Mrs. Robert Dalton, treasurer.

The Harrisonburg Alumnæ Chapter held its annual Saint Patrick's party on Friday evening, March 14, in the gymnasium of Walter Reed Hall. The hall was attractively decorated in green and white and the tallies, refreshments, etc., carried out the same color scheme. Ten prizes, donated by the merchants of the town, were given away to those making the ten highest scores. The members of the Harrisonburg High School Senior Class were the honor guests. The Harrisonburg Chapter recently turned in one hundred and twenty-five dollars to the Johnston Memorial Fund.

Mattie C. Worster, the indefatigable president of the Portsmouth Local Alumnæ Chapter, writes the following concerning the alumnæ there: "You may count on the Portsmouth Chapter for $100 at your Founders' Day program. Our treasurer, Elizabeth Thomas, will send you a check for that amount the first of the week. We gave a subscription card party on February 17, and everything went off all O. K. We had planned for a hundred tables, but fell short a few. Nevertheless, after paying all expenses, we cleared between $85 and $90. Not quite all has been turned in, and that is why I cannot mail the check now. I just hope that it will help some girl who really needs it and wants an education.

PERSONALS

Sallie Blosser is supervisor of science in the Harrisonburg Training School.

Dorothy S. Garber is assistant professor of science in the State Teachers College, Harrisonburg.

Eugenia Beazley, class '29, is teaching general science in Clifton Forge High School.

Elizabeth A. Carroll, class '25, teaches arithmetic in the grades at Earlehurst, Va.

Sarah Hartman teaches science at Amherst, Va.

Lelia Brock Jones teaches general science at Windsor, Va.

The majority of science taught in the Woodrow Wilson High School, Portsmouth, Virginia, is taught by Harrisonburg girls. Ruth Rodes, Nancy Roane, and Frances Tabb teach general science and chemistry. Audrey Chewning teaches math in the same school.

Merle Senger teaches science in Wakefield, Va.

OUR CONTRIBUTORS

OTIS W. CALDWELL is director of the Institute of School Experimentation and professor of education in Teachers College, Columbia University. Dr. Caldwell has been a leader in the field of general science, and is author of various books, including the widely-known Caldwell and Eikenberry *General Science*.

FRED C. MABEE is professor of chemistry in the State Teachers College at Harrisonburg.

BERTHA McCOLLUM is second grade supervisor in the Harrisonburg Training School.

MARY ANN NICHOLS, CLARA PAYNE, LENA WOLFE, GERTRUDE BAZZLE, NANCY SUBLETT, ELIZABETH RUSS, MARY T. E. CRANE, and REBECCA BEVERAGE are all students in the State Teachers College at Harrisonburg.

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